Remarks:

The amendments to the specification bring in the specification from abstract and original claim 4 the main futures of present invention as compared with invention of Brupbacher et al US Patent 5059490. No new matter has been added.

Claims 2-4 and 17-20 are pending in this application. Claims 2, 3 and 18-20 are rejected. Claims 5-14 are withdrawn from consideration. Claims 4 and 18 have been canceled. Claims 2, 3, 17 and 19 were amended to change dependency, claim 20 was amended to add particles of Al_8V_5 compound. New independent claim 21 and new depended claims 22 were added. This independent claim 21 is combination of old independent claim 18 and depended old claim 4. No new matter has been added

THE PRIOR ART REJECTION

Claims 2,3,18-20 are rejected under 35 USC 103 as being unpatentable over Brupbacher et al (US Patent 5059490) in view Gottselig et al.(US 4,961,529).

For an obviousness rejection to be proper, the Patent Office must meet the burden of establishing a prima facie case of obviousness. The Patent Office must meet the burden of establishing that all elements of the invention are disclosed in the cited publications, which must have a suggestion, teaching or motivation for one of ordinary skill in the art to modify a reference or combined references.[1] The cited publications should explicitly provide a reasonable expectation of success, determined from the position of one of ordinary skill in the art at the time the invention was made.[2]

It is an object of the present invention to provide whisker reinforced metal matrix composite materials comprising in-situ precipitated complex ceramic whiskers distributed throughout metal matrixes. The invention is suitable for the manufacture of flat or shaped

---

1 *In re Sang Su Lee, 277 F.3d 1338, 61 USPQ2d 1430 (Fed. Cir. 2002).*

2 *In re Fine, 5 U.S.P.Q.2d 1596, 1598 (Fed. Cir. 1988); In re Wilson, 165 U.S.P.Q. 494, 496 (C.C.P.A. 1970); Amgen v. Chugai Pharmaceuticals Co., 927 U.S.P.Q.2d, 1016, 1023 (Fed. Cir. 1996);*

titanium matrix composite articles having improved mechanical properties such as lightweight plates and sheets for aircraft and automotive applications, heat-sinking lightweight electronic substrates, bulletproof structures for vests, partition walls and doors, as well as for sporting goods such as helmets, golf clubs, sole plates, crown plates, etc.

We agree with Examiner that The Brupbacher patent contains some hard particles mentioned in our original Application. We agree with Examiner that The Brupbacher does not specify the presence of the complex carbide-silicide particles in the titanium matrix composite material as claimed. Gottseilig et al. (US 4,961,529) invention concerns a method of welding together silicon carbide parts or brazing silicon carbide and metal parts together by means of a special bonding layer on a silicon carbide joint surface. It includes the provision of a silicon carbide component having a joint surface prepared for brazing to a metal part. The Gottseilig et al. (US 4,961,529) invention is about brazing silicon carbide parts by sintering Ti_3SiC_2 particles to form a solid layer of Ti_3SiC_2.

We disagree with Examiner that it would have been obvious to one of ordinary skill in the art that during the direct synthesis process of Brupbacher et al US Patent 5059490 the claimed Ti_3SiC_2 would be formed in presence of SiC and Ti as evidenced by Gottseilig et al. (US 4,961,529) (abstract). Gottseilig et al. (US 4,961,529) does not relate to titanium matrix composite at all. This layer cannot be used for reinforcing titanium matrix composites.

Claims 4 and 17 are rejected under 35 USC 103 as being unpatentable over Brupbacher et al US Patent 5059490 in view Gottselig et al.(US 4,961,529)as applied to claim 18 and further in view of Toyoda et all.(US Pub. 2003/0084969) We disagree with Examiner as described above. Neither one of Gottseilig et al. (US 4,961,529) or Toyoda et al. (US Pub. 2003/00884969 A1) contain data about improving mechanical properties of titanium matrix composite materials by complex carbide-silicide particles such as mentioned in our invention objective of the Toyoda et all. invention to provide a Ti-base wire rod for forming molten metal, which is excellent both in feeding smoothness and arc stabilizing property in welding or thermal spraying, and is capable of ensuring desirable mechanical properties of the resultant weld portion, and quality of obtained thermal sprayed layer.

Also these elements have effect of stabilizing the .beta. phase, and are effective in improving hot workability and strengthening through annealing. It is to be noted, however, that all of the elements are likely to form intermediate phase with Ti (e.g., $TiCr_2$, TiFe, Ti_2Ni, TiMn, Ti_2Cu), and excessive addition thereof will tend to degrade the ductility and toughness, so that the upper limit of the amount of addition is defined as 15 wt % in total. The addition in an amount of at least 0.5 wt % in total is preferable to achieve a more distinct effect. Ni may sometimes be added only in a small amount in order to improve corrosion resistance of the alloy" (see paragraphs 0011 and 0038 US Pub. 2003/00884969).

In the present invention "a fully-dense discontinuously-reinforced titanium matrix composite material comprising a matrix of titanium or titanium alloy as a major component, ceramic and/or intermetallic hard particles dispersed in the matrix in an amount more then 15% or less than 50% by volume TiC, B_4C, SiC, ZrC, TaC, WC, NbC, TiAl, Ti_3Al, $TiAl_3$, $TiAlV_2$, complex carbide particles selected from the group consisting of $Ti_4Cr_3C_6$, Cr_3C_2, Ti_2AlC, Al_4C_3, V_2C, (Ti,V)C, VCr_2C_2, and $V_2Cr_4C_3$, additionally contains complex carbide-silicide and carbide-aluminide particles selected from the group consisting of Ti_3SiC_2, Ti_3AlC_2, Al_4SiC_4, $Al_4Si_2C_5$, and Al_8SiC_7" as claim in new independent claim 20. Toyoda et al. (US Pub. 2003/00884969 A1) [0038] **advocates that $TiCr_2$ intermetallic particles formed in the metal matrix degrade the ductility and toughness, so that the upper limit of the amount is defined as 15 wt.% in total.**

Also, Toyoda et al. (US Pub. 2003/00884969 A1) does not relate to titanium matrix composite as a final product, this invention is used for manufacturing master alloys, in other word for melting together with other components. When melting, the material does not exist anymore, which means that the material does not need any strength, and we cannot discuss a reinforcing role of hard particles.

Neither one of prior art documents: Brupbacher et al. (US 5,059,490), Gottseilig et al. (US 4,961,529) or Toyoda et al. (US Pub. 2003/00884969 A1) **contain aluminum-vanadium Al_8V_5 hard particles which is incorporated into titanium matrix according to our claims 20 and 21.**

We agree with the examiner, those above-mentioned carbides, silicides, aluminides and other compounds can be formed in the matrix during sintering, as the result of reactions between components of the initial powdered blend. However, they either can or cannot be formed, nobody can control this process completely. Therefore, we include such powders as Al_8V_5 and $TiCr_2$ in ready form into the basic blend which will be subjected to compaction and sintering, while in the prior art, these particles are resulted from the chemical reaction during the sintering, and the inventors cannot prove if they really appeared or not. We incorporate these particles in the predetermined amount and with the predetermined particle size, in other words, we control the effect of these dispersed particles on mechanical properties of the resulting titanium matrix composite. Intermetallic particles Al_8V_5 play a very important role in hardening of the titanium matrix composite based on the Ti-6Al-4V matrix as the matrix. The Al_8V_5 particles have the composition that is chemically very close to the matrix alloy, therefore they form very strong chemical bonds with the matrix alloy grains during sintering due to facilitated diffusion between said particles and the matrix alloy. Thus, the Al_8V_5 hard particles are most effective structural strengthening component among other hard particles, and the presence of Al_8V_5 hard particles is necessary to the invention as it is possible only by incorporation them into the initial powdered blend before compaction and sintering the composites.

Applicants assert that Brupbacher et al., Gottseilig et al and Toyoda et al does not disclose, teach or suggest anything about flat or shaped titanium matrix composite articles having improved mechanical properties such as lightweight plates and sheets for aircraft and automotive applications, heat-sinking lightweight electronic substrates, bulletproof structures for vests, partition walls and doors, as well as for sporting goods such as helmets, golf clubs, sole plates, crown plates, etc., as claimed in claims 2,3 and 20-22. Therefore, Claims 2,3 and 20-22 are patentable over Brupbacher et al., Gottseilig et al and Toyoda. Allowance of Claims 2, 3 and 17,19 - 22 are respectfully requested.

It is respectfully submitted that applicants' comprehensive discussion of the relied upon in the rejection and of the differences between applicants' claims and the prior art

provides a firm basis for the conclusion that applicants' claims are directed to subject matter which is not obvious in view of the prior art.

Should any questions arise, the Examiner is encouraged to contact the undersigned.

Respectfully submitted,

Vladimir S. Moxson

Dr. Vladimir S. Moxson

ADMA Products, Inc.
1890 Georgetown Rd.
Hudson, OH 44236